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TEST AND EVALUATION OF QUALITATIVE AND QUANTITATIVE PERSONNEL REQUIREMENTS INFORMATION

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FOREWORD

This report is one of a series of reports related to human factors testing in Air Force Systems and represents a portion of the applied research program of the Personnel and Training Requirements Branch, Training Research Division of the Behavioral Sciences Laboratory. The program is under Project 1710, "Training, Personnel and Psychological Stress Aspects of Bioastronautics," Task 171006, "Personnel, Training and Manning Factors in the Conception and Design of Aerospace Systems." Dr. Gordon A. Eckstrand was the project scientist, and Mr. Melvin T. Snyder was the task scientist. The portion of the work reported here was sponsored by the Training Research Division through the AFIT graduate program. The work was performed by Captain Stackfleth in 1963 while a graduate student under the guidance of Dr. Ernest J. McCormick at Purdue University.

The Behavioral Sciences Laboratory has initiated a program to develop methods for human factors testing of Air Force Systems. This program, in support of personnel subsystem test and evaluation, has at least two facets: The evaluation of human performance during Category I, II and III system testing; and the evaluation of previously developed personnel subsystem elements, like Qualitative and Quantitative Personnel Requirements Information (QQPRI). This report is related to the second facet. The criterion and the predictor problems cited for QQPRI are probably common also to the test and evaluation of other personnel subsystem elements.

This technical report has been reviewed and is approved.

WALTER F. GRETHER
Technical Director
Behavioral Sciences Laboratory

ABSTRACT

Some of the problems in the validation of personnel requirements developed and predicted in the Qualitative and Quantitative Personnel Requirements Information reports are described. Included are problems inherent in the validation procedures, such as the nature of the predictor (QQPRI), the problem of criterion selection and bias, and the changing nature of the criterion. Because of the multiple nature of these problems, available testing techniques are not adequate to handle the testing and provide desired information. A solution is presented. This solution requires a procedural change whereby validations are conducted during different but specific stages of system development and test. The validations would be oriented to obtaining the best validation at a particular time and for a particular purpose rather than attempting an overall test. Methods are suggested for determining manning deficiencies and readjusting the personnel subsystem.

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INTRODUCTION

Prior to the weapon system concept, the individual systems of an aircraft were assembled from state-of-the-art equipment. Components and the accompanying skills could be interchanged easily among systems. Sometimes an aircraft was built, but operational use delayed because the personnel system had not been provided the required planning factors. As a result, appropriate decisions were not made as to the kinds and numbers of people needed to operate and maintain the new weapon system.

Since 1954, increasing attention has been focused on the problem of placing adequately trained operator and maintenance support personnel in the field simultaneously with the hardware and procedures. Initially, many organizations and individuals supported work in the areas of human engineering, personnel requirements, and training requirements to meet the needs of these weapon systems. As experience was gained, it became increasingly evident that these functions should not be separate but rather that all aspects which unite the human component with the weapon system should be integrated more closely. This concept resulted in an intra-Air-Force-command agreement designated the personnel subsystem (PS). The PS as conceived contains eight separate elements, one of which is PS test and evaluation. (See Appendix I for list of PS elements.)

To date, possible methods of verifying the planning that has gone into the development of the PS for any given weapon through PS test and evaluation are almost nonexistent. While the problem of testing the entire PS is beyond the scope of this paper, an attempt will be made to explore some of the problems of testing on PS element, the Qualitative and Quantitative Personnel Requirements Information (QQPRI), in an attempt to offer suggestions for resolving the problem. Until these problems are stated and considered, the process of developing more detailed test design which will actually provide the desired verification cannot be expected to be fruitful.

TEST PURPOSES

The Handbook of Instructions for Aerospace Personnel Subsystem Designers (HIAPSD) (AFSCM 80-3) states that there are, in general, two primary reasons for testing the elements of the personnel subsystem. These are:

1. To determine the degree to which the PS elements meet their objectives.

2. To point out the nature and extent of deficiencies which may exist in any of the given PS elements.

Human Performance Test

Shapero, Cooper, Rappaport, and Schaeffer (ref 13) while evaluating nine Air Force missiles, reported that little if any systematic human factors performance testing is being undertaken. They stated that an analysis of 4,248 malfunctions indicated that the proportion of human error varied from 20-53% of reported equipment failures, and from 16-23% of the unscheduled delays. Even so, the malfunction data collection system being utilized was inadequate for identifying or obtaining pertinent data on human initiated equipment malfunctions.

Because of the influence of the human component on malfunctions, Shapero suggests that for human engineering, some method of test should be established which will meet the following criteria where human operators are concerned:

1. There should be a method for obtaining consistently defensible, observable measures about the human operator with procedures for validating these observations.

2. These methods should be referable to existing models of systems of known components.

3. These methods should allow modification of work areas and work places.

4. They should account for where and how the human operator enters the system at each level of the system.

Personnel Requirements

Demaree, Marks, Smith, and Snyder (ref 4) indicate that three specific purposes are served by the QQPRI program:

1. Identification of Air Force specialties and specialty codes for the positions required for maintenance and operation of a given Air Force system.

2. Development of essential information for the organizational tables and unit manning documents.

3. Provision of timely and valid information for the planning of training courses and other system supports.

If these are the purposes of QQPRI, then the problem seems to be one of testing how accurately the prediction of Air Force specialties, numbers of personnel required, and amount of training required have been accomplished. If the prediction and criterion measures are in accord, no problem exists. Powe, Carrier, and Skandera (ref 12) while conducting a test of the human factors portion of the IM 99 A system reported an inadequate number of personnel available to process the missile and an inadequate percentage of 7 level (skilled) airmen. This test indicated that the QQPRI grossly underestimated the requirements in these two areas. What were some of the reasons for this underestimation? For one thing, none of the automatic checkout equipment operated in a fully automatic manner, and continuous contractor assistance was required with "work around" procedures being developed for the operation. In any case, the operational plan could not be met and modification of the facilities was required. Thus, we have an indication that, while the personnel requirements were in error, this was in part a result of factors concerned with the weapon system as a whole as well as the personnel system. Losee, Payfer, Frahm, and Eisenberg (ref 9) have shown that manpower requirements permeate every aspect of the weapon system. Thus, the sources of error possible are dependent not only upon the direct aspects of the personnel prediction, but also any facet of the weapon which might constitute an error source (see figure 1).

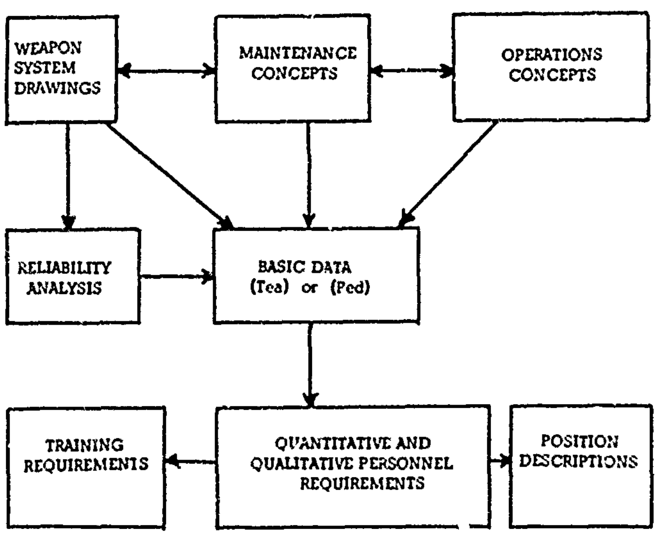

Figure 1

Interrelations of Personnel and System Information (Adapted from Losee et al, ref 9, page 8)

Errors in any of the information sources feeding into the QQPRI will have an impact on the final personnel predictions contained in the QQPRI, and while not illustrated in figure 1, the QQPRI may in turn modify the assumptions concerning the complete weapon system.

DYNAMIC NATURE OF THE PREDICTOR

QQPRI Revision

When considering the validation of the QQPRI, a somewhat different situation exists from the normal test design. For one thing, since QQPRI is essentially a planning program and document, the knowledge of the predictor is widespread, and by definition every attempt is made to correlate the predictor with the "criterion," so that right or wrong, once the prediction has been made, the intent is that the predictor shall become fact. In those cases where operational or hardware modifications are implemented, the QQPRI is also modified. Losee et al, ref 9, p 2, stated:

> A static QQPRI would reflect only the original design thinking and the original concepts. Since development of aerospace craft, missile, or electronic weapon systems must necessarily be dynamic in nature, the QQPRI must also be dynamic, ie, an updating process must occur . . . .

Prediction at Various Stages of Weapon System Development

Losee et al further suggest that such QQPRI revisions might reasonably be expected at the time of the first firm drawing release, at mock-up time, during prototype testing, following Category II test, and during the production phases. These revisions may or may not result in discrete publications depending upon the extent of the changes. On the basis of a study by Glanzer and Glaser (ref 7), Losee and others have recommended that the best prediction can be made following development of prototype equipment. This may be the earliest prediction which can be made with reasonable stability. However, in view of the dynamics of the situation, accuracy of the prediction may well be inversely proportional to the length of time between the prediction and testing, or more specifically to the degree of change occurring in the system between prototype development and the final operational configuration. This is based upon the assumption that as additional information becomes available and designs are firmed up, fewer changes will occur between the prediction and the test resulting in greater validity. It would be a dangerous assumption to infer that because an item of equipment had reached some milestone in development and was successfully tested at that point, that other systems would give similar test results at that point in time.

Ghiselli (ref 6) in discussing dimensional problems of criteria, points out that in a particular testing situation, he found that the point in time that a criterion measure was observed influenced the accuracy of his prediction. He concluded that to obtain validity, prediction would have to be of performance fairly closely pinpointed in time.

Because of the dynamic nature of the predictor, the decision as to when the validation should take place will, in general, be a major factor with regard to how well the predictor relates to the criterion, since I would expect that the closer in time the two occur, the better will be the prediction.

DYNAMIC NATURE OF THE CRITERION

A problem of major concern is the point in time during which validation of personnel requirements should occur. The earlier the test can be made, the more opportunity for correcting deficiencies before the weapon system is introduced into the field with its attendant costs of trained personnel. The earlier required modifications are made, the less costly subsequent planning operations will be. An initial estimate might suggest that this evaluation should be accomplished during weapon system test.

Weapon System Test

A period of time (Category I, II, and III tests)* is allotted to each weapon system for testing before operational use. However, several aspects of the weapon system test situation do not lend themselves to validation of the predicted personnel requirements of the system:

1. System design may vary during the test situation. For example, ground support equipment may not be developed so that it can be used in conjunction with the prime equipment. The use of substitute equipment may drastically change the duties and tasks which are to be performed during the test period. Likewise, equipment reliability at this time may not be representative of the reliability which can be expected after operational use, so that the frequency of duty and task performance is likewise not representative. The few available items of equipment are being fully utilized for hardware test, so they are difficult to obtain for testing the human component.

2. Personnel who actually participate in the test may not be similar in skills to the operational personnel. During the early phases

*See Appendix II for description of Category I, II, and III tests.

of testing, equipment test is handled by contractor personnel already stationed at the test site. During Category III tests, the individuals sent from the operational squadrons may not be representative in skill or knowledge to those airmen who will eventually be expected to operate the system in the operational context.

3. Learning factors can be expected to increase the time required in performing jobs both in the test and early operational phases of the system.

Testing the personnel prediction at this point in time results in a test conducted under different assumptions than those for which the prediction was developed. That appropriate personnel must be available to support system test may be a valid argument, but to do this the underlying assumptions pertaining to personnel requirements must be modified to conform to the testing situation.

Brogden and Taylor (ref 1) have suggested four biasing factors that may produce a deviation of obtained criterion scores from a hypothetical "true" criterion score. These factors are classified as:

1. Criterion deficiency—omission of pertinent elements from the criterion.

2. Criterion contamination—introducing extraneous elements into the criterion.

3. Criterion distortion—improper weighting in combining criterion elements.

4. Criterion scale unit bias—inequality of scale units in the criterion.

The first three items are particularly relevant to testing QQPRI during weapon system test.

Criterion Selection

Another problem to be considered is the difficulty involved in selecting and establishing a criterion. Even if the criteria could be stated simply as "the number and types of personnel required to actually operate the system in the field," it would still be difficult to obtain an accurate picture of just how many personnel are required.* What approach might be used to answer such a question? Certainly

*The problem of overall manpower utilization appears to be a shade different than performance testing of individuals in their respective jobs.

at present insufficient data exists regarding what a man can do, or what constitutes a full day's work, so that an answer may reasonably be expected to come as a result of "expert" judgment. Who is in the best position to judge the field situation? The unit commander and his staff are logical candidates, however they may be somewhat biased toward increasing the number of personnel required. This does not necessarily result from Parkinson's Law, but comes from the very real and practical situation of having suffered through personnel acts during previous periods so that a little "padding" might be regarded as genuine foresight.

An alternative method might utilize the judgment of personnel knowledgeable about the problems and operations of several similar bases or commands. Having access to a larger scope of operations via observation of similar organizations might be a reasonable place to obtain judgments of what is actually a fair proportion of the available manpower which can be allotted to a functional unit. This too has the possible disadvantage of contamination of criteria because here the inclination is toward a proportionate share of manpower and skills rather than a judgment of what is actually dictated by the job. A combined judgment similar to that used during the development of personnel prediction information might assist in this phase; that is, utilizing a combination of unit personnel and higher echelon personnel or an independent group of well qualified judges.

Clifton (ref 3) in a study of staffing requirements for Navy CVA 59 and 61 class ships found reliabilities generally in the .90's among estimates of desirable and minimum levels of personnel, as compared to numbers of personnel allocated by the Bureau of Naval Personnel. While this situation differs somewhat in that the ships were already in commission, the stability of judgments does provide an indication that usable criteria can be obtained.

Assuming that simple criteria can be established for validation purposes, will a simple criterion be sufficient?

Need for Multiple Criteria

Noriega, Jowdy, and Palmer (ref 11) in developing a methodology for optimum manning for base level aircraft maintenance have suggested several criteria which they feel are important for a personnel prediction system. A few of these are as follows:

1. Maintenance manning should be oriented toward operational readiness.

2. Optimal utilization of USAF maintenance manpower should be provided.

3. Maintenance support requirements of operational units must be met.

4. Objective justification and validation of manpower requirements must be provided.

5. The prediction system must be usable within the parameters of current organizational operations and maintenance concepts and be responsive to subsequent changes in these concepts.

6. The prediction system must be responsive to all factors influencing maintenance workload.

7. Portions of total workload by quantity, quality, and types of skill categories must be isolated.

8. AFM 26-1 must be utilized.

9. Means of identifying manning expenditures above and below established requirements must be provided.

Review of these items indicates two important factors; first, that a single criterion would not provide a sufficient basis for validation, and second, a mixture of criteria has occurred, one facet dealing with criteria for the predictor (5) and the other pertaining to some measure of field test (3). From the viewpoint of ultimate requirements both facets are required, but the question remains, are they compatible for a single test?

Validation Using a "Best" Predictor and "Best" Criterion

One approach would be to select a "best" point in time for the predictor to be held constant, then establish a criterion during that point in time when the system is considered to be in its average operational condition, that is, subsequent to the time when the majority of the "bugs" have been eliminated from the system and the personnel maintaining it have become familiar with the equipment. By comparing the predictor with the criterion at these selected points in time, it would be possible to determine the degree of accuracy with which predictions were made on that system. Unfortunately, this "best" point in time would probably not occur until the system was already operational. The knowledge gained at this stage would be of little help for the system under study. However, it would have the advantage of recording the deficiencies of a system presently in operation, then insuring that procedures for procuring that type of data were incorporated into future prediction procedures. Because of the number of variables involved and the changing conditions resulting from a lapse of years between prediction and validation, the information received would at best be of a general rather than a specific form.

Mid-Point Resume

In view of the diverse problems discussed up to this point, perhaps a short summation is in order:

1. It is necessary that some evaluation of personnel requirements be made at an early time period.

2. Many factors aside from the personnel prediction will influence the results of these evaluations. Among these are:

   a. The inseparability of the equipment and personnel factors.

   b. The time chosen for conducting the test.

   c. The decisions regarding the constituents of the ultimate criterion.

3. By holding several factors constant, a test could be run on a specific system to determine deficiencies in the prediction system. However, the information would be expected to be general in nature, too late for major contribution to the weapon system being tested, and not generalizable to a future system.

4. In view of these factors, it does not appear practical to test simultaneously the adequacy of the weapon system and the adequacy of the predictor.

AN ALTERNATIVE APPROACH TO VALIDATION

Chase (ref 2) has suggested that two phases exist in the validation problem:

1. Testing the basic data from which predictor information is later developed.

2. Evaluation of actual performance on the job: that is, whether or not the personnel can perform their mission. He suggests that this type of validation can be performed through observation of personnel performance.

Since studies of the evaluation of performance have already been undertaken, a brief review of this topic may be appropriate before proceeding to a discussion of validating the basic data.

Human Performance Evaluation

The procedures and techniques used in human performance evaluation are by no means new, although their application in the weapon system test program has been somewhat limited. Aside from classified tests, examples include:

1. Powe, Carrier, and Skandera (ref 12) used checklists and interviews as well as observation during human factors test of the IM 99 Weapon System.

2. Clifton (ref 3) in attempting to determine staffing requirements for naval vessels, used a diary approach with good result.

3. Marx (ref 10) recently considered in some detail the methods of evaluating human performance. This report thus serves as an additional source of information on these procedures.

In general, application of techniques contained in AFM 35-1 and AFM 26-1 may also furnish appropriate guidelines for evaluating the numbers and types of personnel in those instances where incumbents have actual job experience. Where problem areas are encountered which result from a difference between the actual operational situation and the QQPRI, updating the QQPRI may serve as a guide to revising personnel requirements. For example, if sufficient personnel are not available, and the malfunction rate is higher than predicted, substituting a revised frequency of task performance may indicate whether this factor alone resolved the problem or whether other factors were also contributing.

In any event, while the predictor information is not in itself being tested, the techniques and information can be useful during performance test as cited above or in pinpointing specific test areas which were expected to present problems such as: critical tasks, safety hazards, complex training, etc.

Validating Basic Prediction Data

Checking the basic data may cover several stages. First, an initial check of the information will be made by the Air Force as it is received from the contractor. One of the possibilities here is to make checks individually of the logical points where omissions of important aspects of the system may occur. Because several hundred tasks may be listed with each being rated according to such characteristics as criticality, newness, complexity, etc, a complete recheck may not be feasible in the time available for review. To accelerate this process, one could reasonably make spot checks.

A matrix (see figure 2) might provide a convenient reference for illustrating combinations of task statements that are not entirely consistent or that might indicate tasks requiring special attention. For example, if a task is rated as requiring an extended period of training time and is also checked as being critical, then further checking of the whole task may be worthwhile. Likewise, a task that has new

Aerospace Ground Equipment (AGE) and requires extended training should receive additional attention. Such a procedure could, using a card sorting system, automatically sort out combinations of task characteristics which indicate either the more important tasks or those which present inconsistencies.

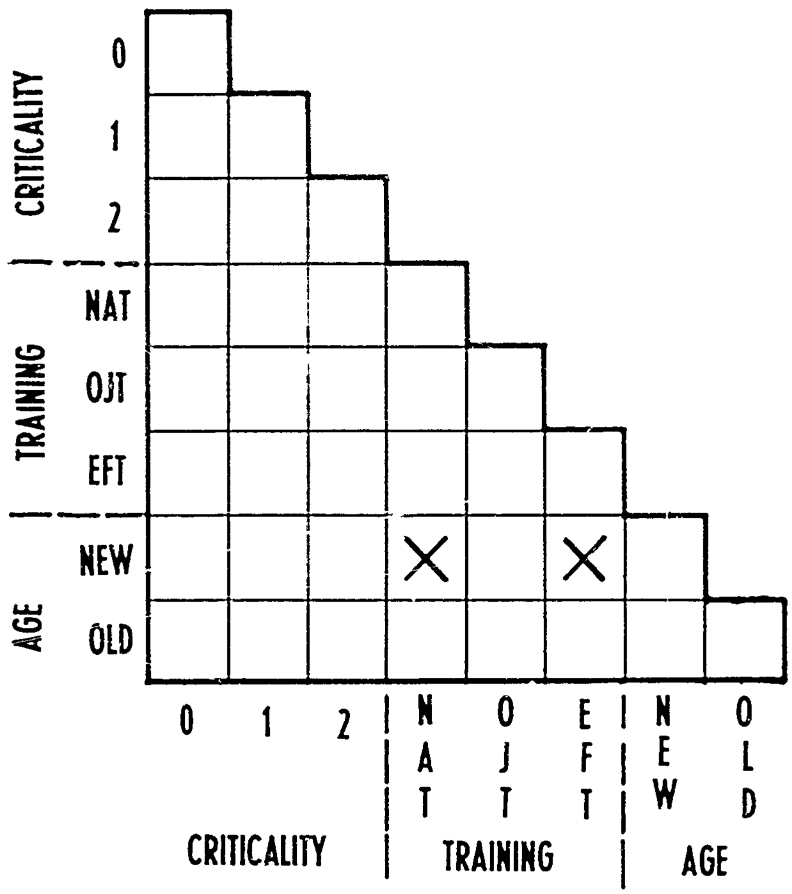

Figure 2. Matrix for Task Qualities

NOTE: NAT is No Additional Training; OJT is On Job Training; EFT is Extended Formal Training

As a further example, if in sorting the cards, an item of new AGE was found to be included in the position but the training description was marked, No Additional Training (NAT), then the analyst must be satisfied that the new item of equipment did not in reality modify the tasks in that position. An unusually large frequency of errors in any one position would indicate that a more detailed check of that particular position was required.

Other techniques at this stage would also be helpful. For instance, check lists could be developed which would aid the analyst in reviewing the report prior to publication

Checklists

Included in such a checklist would be items such as:

1. Do the number of aircraft programmed for maintenance and the number allocated to training flights, etc, add up to the total number of aircraft assigned to the squadron?

2. Have appropriate allowances (as per Air Force Manuals) been made for leave, sickness, etc, when considering personnel available for duty?

3. Recheck other clerical verifications already built into the prediction form.

Task Simulation

Vacherot and Teeple (ref 14) have proposed a system for simulation of manpower requirements. The methodology of that system appears to present some rather interesting prospects of being adaptable not only for prediction purposes, but perhaps for use in integrating several techniques developed independently. This technique involves the simulation of a 24-hour period reduced to 1-1/2 hours by using digital computers. In this scheme, factors such as the following are included:

1. Location and time at which the task commences.

2. The location, number, and capabilities of men available to perform the task.

3. The logical rules to be employed in treating tasks and men.

The program commences with a number of men with specified abilities at a given location. Then the tasks to be performed are introduced chronologically. This procedure continues on a 24-hour basis to measure the efficiency of manpower utilization. The procedure is divided into three phases:

1. The load generation phase in which the task frequencies for 24 hours are programmed.

2. The originating time of the task is programmed.

3. A task length is chosen at random from a specified distribution.

The AFSC priorities are established, the borrowing priorities are established, and the maximum delay time is fixed.

During the simulation phase, the tasks are fed into the process on the basis of the programmed information. If the task can be delayed, it is and if it is not delayable, another tasks is substituted. Then the priorities for borrowing are searched and other personnel are used with consideration being given to their non-availability for the performance of previously assigned tasks. If the search is not fruitful, then the requirement for the "creation" of a new position exists.

The methodology proposed by Losee et al has attempted to show how a great number of the variables affecting personnel requirements can be integrated for a single weapon system. The contents of their report consider in some detail the importance of task frequencies in determining manning requirements, and present some new methods for estimating the frequencies from equipment reliabilities. Other phases proposed in this simulation model would also be available as an outgrowth of using the technique proposed by Losee. Examples are:

1. Availability of task information in sequence.

2. Length of tasks.

3. Delays resulting from differences in task location.

Thus, the personnel requirements predictions would be established initially utilizing the basic assumptions, task estimates, and other data which could be made available on the basis of the requirements generated by the weapon system. Gael and Stackfleth (ref 5) have shown the feasibility of using card systems for the initial data collection for this purpose, and a card system was used for data collection in the Minuteman Missile program. The manpower prediction technique proposed by Losee was designed to be adaptable to card or tape programming techniques which would allow not only the fallout of the original data for planning information, but would, with minor modifications, allow the simulation procedure to utilize the same data for a more thorough and rapid check than has been possible in the past. Thus, within a short time span the system cycle could be completed. At this stage it would be known whether the system as conceived and planned could operate under the known conditions imposed upon it. The degree of latitude in terms of assumptions and estimates would be more fully known, and in addition, this technique would allow research on those factors tending to affect the final results in terms of numbers of people required, thus permitting additional insights into those areas which should be looked at more closely during weapon system test.

The probabilities of malfunctions on which the task frequencies are based should be very amenable to this kind of programming. Additional research in the area of programming skills and knowledges would be required.

The first run of the program would essentially provide data regarding deficiencies of the prediction system. Any instance where a problem was encountered would be recorded and subsequently analyzed for improvement of later predictions, and any required changes in the prediction system could be corrected to remove these deficiencies. In essence then, this simulation would be validating the prediction system. On subsequent runs, ie, after the first, the simulation technique could be used to better design the personnel area in terms of its own internal consistency.

SUMMARY AND CONCLUSIONS

Because of the continuing requirement for valid personnel information pertaining to new weapon systems, a requirement exists for testing and evaluating prediction of personnel requirements. This report reviews some of the problems in the validation procedure, such as the nature of the predictor (QQPRI), the problem of criterion selection and bias, and the changing nature of the criterion. I conclude that, because of the nature of this problem, available testing techniques are not sufficient to handle the multiple problems and provide the desired information; rather it is suggested that the validation procedure be conducted during different stages specifically oriented toward obtaining the best validation at a particular time and for a particular purpose rather than attempting an overall test. Suggestions are included for performing these tests to obtain the desired result. In particular, a system of task simulation is suggested that may be of use both in determining manning deficiencies and in redesigning portions of the Personnel Subsystem.

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APPENDIX I

PERSONNEL SUBSYSTEM ELEMENTS

1. Personnel-Equipment Data (PED).
2. Human Engineering (HE).
3. Qualitative and Quantitative Personnel Requirements Information (QQPRI).
4. Training Plans (TP).
5. Training Equipment Planning Information (TEPI).
6. Training Equipment Development (TED).
7. Technical Orders and Technical Manuals (TOTM's).
8. Personnel Subsystem Test and Evaluation (PSTE).

APPENDIX II

WEAPON SYSTEMS TESTS

Category I — Subsystem Development Tests and Evaluation

This consists of the individual components and subsystems of a system. In addition to qualification, this testing provides for redesign, refinement and reevaluation as necessary. Some of the test objectives are to determine:

1. Performance, reliability, and integrity of individual components.
2. Compatibility of noted components.
3. Compatibility of government furnished equipment or standard Air Force items for incorporation into the system.
4. Airborne operation characteristics and air worthiness of subsystems and components of the system.
5. Preliminary performance, stability and control characteristics, and general air worthiness of the air vehicle.
6. Compatibility and adequacy of ground support equipment.
7. Preliminary maintainability characteristics of components and subsystems.
8. Initial requirements for personnel and training, skill identification and the adequacy of personnel training devices.

Category II— System Development Test and Evaluation

This consists of development testing and evaluation of integrated subsystems. It will include functional and development tests and military demonstration of the whole system in as realistic and complete environment as practicable.

Some of the test objectives are:

1. Determine compliance with specifications for performance, stability, control, and maintenance; and obtain necessary data for handbook and other publications.

2. Evaluate new design changes for production.

3. Determine capabilities under simulated climatic conditions.

4. Demonstrate in as realistic and complete environment as practicable that the whole system is functionally operative, operationally effective, and compatible with the other systems and supporting equipment required for its operative employment.

5. Determine if the system is capable of and suitable for meeting the established requirements and design objectives.

6. Provide opportunity for familiarization, experience, and limited training on the system to prime major air command and ATC personnel.

7. Demonstrate in the most realistic environment practicable that the complete system is maintainable with minimum resource outlays, ie, support and test equipment, personnel and skills, special tools and training, spare parts, and special facilities.

8. Determine the adequacy of ground support equipment.

Category III — System Operational Test and Evaluation

This consists of a major air command user tests and evaluations of operationally configured systems with all components, support items and personnel skills, under operational conditions. Some of the test objectives are:

1. Determine the operational usefulness of the system and develop the most effective operational tactics, techniques, doctrines and standards.

2. Determine any operational deficiencies and provide quantitative and qualitative data for product improvement programs.

3. Obtain supplemental data on the rate of parts consumption, maintenance and support facility requirements obtained during previous tests.

4. Obtain supplemental data on organizational and personnel skill and training requirements procured during previous tests.

5. Evaluate the adequacy of the Table of Organization, the training program, and the authorization documents.

6. Obtain supplemental data relative to minimum maintenance requirements in terms of personnel, skills, and training; special tools, test and support equipment; special facilities: general performance standards for doing maintenance tasks.

7. Qualify and integrate the first using command units into the operational inventory.

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13 ABSTRACT

Some of the problems in the validation of personnel requirements developed and predicted in the Qualitative and Quantitative Personnel Requirements Information reports are described. Included are problems inherent in the validation procedures, such as the nature of the predictor (QQPRI), the problem of criterion selection and bias, and the changing nature of the criterion. Because of the multiple nature of these problems, available testing techniques are not adequate to handle the testing and provide desired information. A solution is presented. This solution requires a procedural change whereby validations are conducted during different but specific stages of system development and test. The validations would be oriented to obtaining the best validation at a particular time and for a particular purpose rather than attempting an overall test. Methods are suggested for determining manning deficiencies and readjusting the personnel subsystem.

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